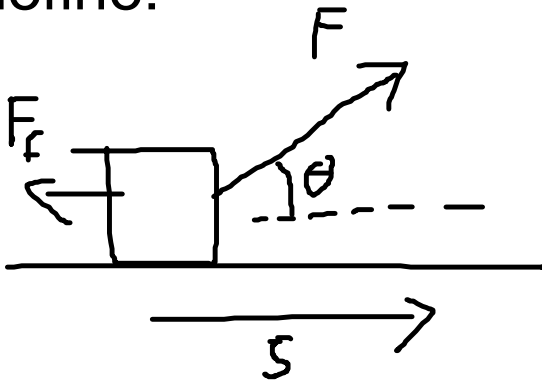


## Work and Energy define:



$$W = F \cdot s \cos \theta$$

$\theta$  is the angle  
between  $F$  and  $s$ .

Work is the vector dot product of  $F$  and  $s$ .  
The integral of  $F$  through  $s$ .  
units : Joules,  $J = Nm$

Energy: ability to do work

units: Joules,  $J = Nm$

work energy theorem:  $\Delta \text{ energy} = W$

A 10.0 kg box is pulled with 50.0 N of force  
35.0° above the horizontal over 3.00m. If  
 $\mu_k$  is 0.20 determine

a) work done by the applied force

$$W = F s \cos \theta = 50 \times 3 \times \cos(35) =$$
$$122.8728066433488$$
$$= 123J$$

a) work done by the normal/restoring force  
 $F$  is perpendicular to  $s$ , so  $W = 0$

a) work done by friction (R is not = mg!)

$$F_f = \mu R$$

$$R = ? \quad F_{up} = F_{down}$$

$$R + F \sin \theta = F_g$$

$$R = mg - F \sin \theta = (10 \times 9.8) - (50 \times \sin(35)) = 69.3211781824477$$

$$F_f = 0.2 \times 69.3211781824477 = 13.8642356364895$$

$$W = F_s = -13.8642356364895 \times 3 = -41.5927069094685 = -41.6 \text{ J}$$

a) work done by the net force

$$F_{net} = \sum F = F \cos \theta - F_f =$$

$$50 \times \cos(35) - 13.86 = 27.09760221444959$$

$$W =$$

$$27.098 \times 3 = 81.294$$

$$W_{net} = W_{app} - W_{fric} =$$

$$122.8728066433488 - 41.5927069094685 = 81.2800997338803 = 81.3 \text{ J}$$

a) change in kinetic energy, final velocity

$$\Delta E_k = W_{net} = 81.3 \text{ J}$$

$$\frac{1}{2}mv^2 = 81.3 \text{ J}$$

$$v = \sqrt{81.280 \times 2 / 10} = 4.03187301387333$$

$$v = 4.03 \text{ m/s}$$

a) energy dissipated as heat  
= work done by friction = 41.6J

$E_g = mgh$  near Earth

$E_{\text{elastic}} = \frac{1}{2}kx^2$

Homework Handout Q1-7

Bungee jumping:

You jump off Capilano suspension bridge, 70.0 m above the river. You are tied to a bungee cord that is 10.0 m long. What spring constant is required for your head to just touch the water? Mass 60.0kg height 1.5m.

What is your acceleration at the bottom (not zero!!!)

Where is the acceleration zero?

p143 Q1-6

p144 Problems 5, 7, 13, 25,